

# Phase diagram of electrostatically doped $\text{La}_2\text{CuO}_{4+x}$

Javier Garcia-Barriocanal

*GFMC, Facultad de Ciencias Físicas, Universidad Complutense de Madrid, Avda. Complutense  
s.n., Madrid 28040, Spain  
School of Physics and Astronomy, University of Minnesota, Minneapolis,  
Minnesota 55455, USA*

In this talk I will show our recent results on Electronic Double Layer (EDL) techniques applied to the study of high  $T_C$  cuprates. The EDL configuration, which employs ionic liquids as gate dielectrics, has succeeded in achieving unprecedented charge transfers of the order of  $10^{15}$  carriers/cm<sup>2</sup>. This large accumulation and depletion of carriers allowed us to explore the phase diagram of  $\text{La}_2\text{CuO}_{4+x}$  ultra-thin films in a continuous fashion, avoiding the presence of miscibility gaps characteristic of bulk samples. The experiments were carried out on 4 unit cells thick samples produced by ozone assisted Molecular Beam Epitaxy. The electronic transport measurements show that the phase diagram of the electrostatically doped sample is characterized by the presence of a Coulomb Gap insulator, a Fermi Liquid metal and a superconductor phase. I will discuss about the electronic properties of such phases emphasizing the different transitions between them.